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ABSTRACT

With the release of ShockWave, MacroMedia Director animations can now be incorporated directly into Web pages to provide high quality animation and interactivity, to support, for example, tutorial style questions and instantaneous feedback. This paper looks at the application of this technique in the translation of a traditional computer-based tutorial, Ariadne's Thread, into an online version. A significant change was evident in its development and implementation processes and impact on the student learning and departmental infrastructure. This change was seeded in part by the increased modularity and open delivery of online Web materials, and in part by the development of specialized interactive learning devices and support tools. In particular, the shift from authoring to writing tools has moved the locus of project control from the technical to educational, involving teachers more directly in development and implementation. A simultaneous shift from a development-centered project approach to one that is implementation-focused, has increased the potential of responding to learning needs on an ongoing basis. Five figures illustrate the program. (AEF)

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An Implementation of Interactive Objects on the Web

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Interactivity on the Web has until recently been accomplished with HTML forms and CGI scripts, lacking the responsiveness of stand-alone computer programs and consequently limiting the effectiveness of learning interactions. With the release of ShockWave, MacroMedia Director animations can now be incorporated directly into Web pages to provide high quality animation and interactivity, to support for example, tutorial style questions and instantaneous feedback. This paper looks at the application of this technique in the translation of a 'traditional' computer-based tutorial into an on-line version. Further, a simple authoring front-end to these interactive elements makes it possible to capitalise on the Web's modularity and potential for efficient development and implementation. It is apparent that changes in roles and responsibilities of all participants can result from this approach.

The tutorial, 'Ariadne's Thread', was originally designed to reduce the load on Library staff and lecturers by increasing the library skills of first year Arts students (Jones & Fritze, 1996). It was developed in HyperCard by the Interactive Multimedia Learning Unit of the University in conjunction with University librarians and lecturers from the Faculty of Arts. The main areas of focus were use of the catalogue system and interpretation of reading list citations. Each topic area in figure 1 consists of several screens employing a combination of information and interactive questions. A mythological metaphor supported the navigational structure of the program, providing a 'thread', hopefully *not* mythical, to assist students in making their way through the 'maze' of the Library.

The program was developed and trialed during 1994 and scheduled computer laboratory sessions organised by library staff were first offered to students on a voluntary basis in 1995.

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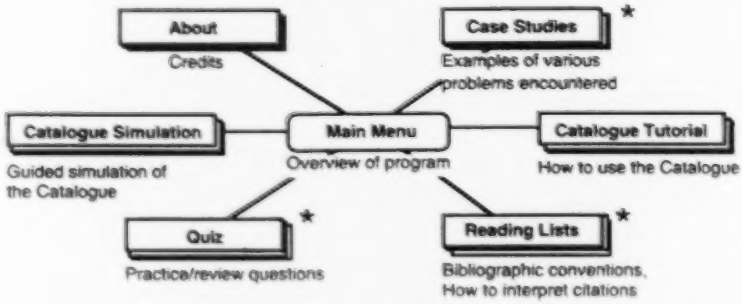

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Figure 1. Topic structure of Ariadne's Thread. (*Topics translated to the Web version)

The Ariadne Collection

In early 1996, replacement of the Library catalogue system made aspects of the tutorial obsolete or in need of review. It was decided to re-purpose the program into on-line format for use within the Library Web site, maintaining the content and style of the original where possible within the following guidelines:

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- Topics relating to the new Library catalogue would be left until experience of the new system had been obtained.
- *Interactive elements*, equivalent to the original style of questions and feedback, would be incorporated directly into Web pages as Macromedia ShockWave documents.
- Librarians and lecturers responsible for instructing students should be able to write and edit both the Web pages and the embedded interactive elements.

Comparing the respective structures, it is clear that the same concept of a self-contained program no longer applied - hence the name change from 'Ariadne's Thread' to the 'Ariadne Collection' of Web resources for the purposes of identifying and funding the project.

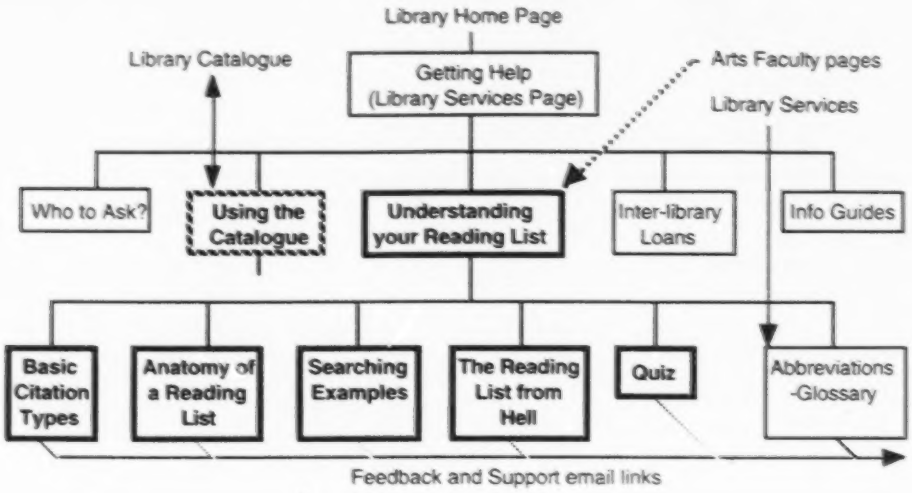

Figure 2. The Ariadne Collection pages (in bold)

Interactive ShockWave Elements

To provide the interactive question and information operation of the original program, a number of separate MacroMedia Director files were developed and converted to Web-compatible ShockWave documents. These formats included multiple choice, citation identification and classification question styles. Figure 3 illustrates how an interactive question element appears when embedded within a standard Web page, providing a series of exercises for the user to identify appropriate search elements of a given reading list citation. In response to the user actions, selected elements are highlighted, and immediate explanatory feedback or rubber stamp 'reward' given. The user can skip back and forth through a number of exercises in the one question.

While the operation of the question is defined in the ShockWave file itself, the content and feedback is specified in an external text file in the form of question script shown in table 1. This text-based approach to authoring follows from protocol used extensively in producing computer based learning materials in Chemistry (Fritze, 1993). When the Web page is loaded, the ShockWave file retrieves the question script file 'Question.txt' across the network and interprets it to configure the question. Generating a web topic page therefore involves skills little more involved than word processing:

1. creating a traditional HTML Web page with associated graphic links etc. using a Web page editor
2. including a 'embed' statement in the HTML, pointing to the required ShockWave file
3. creating the corresponding question script file in any word processor

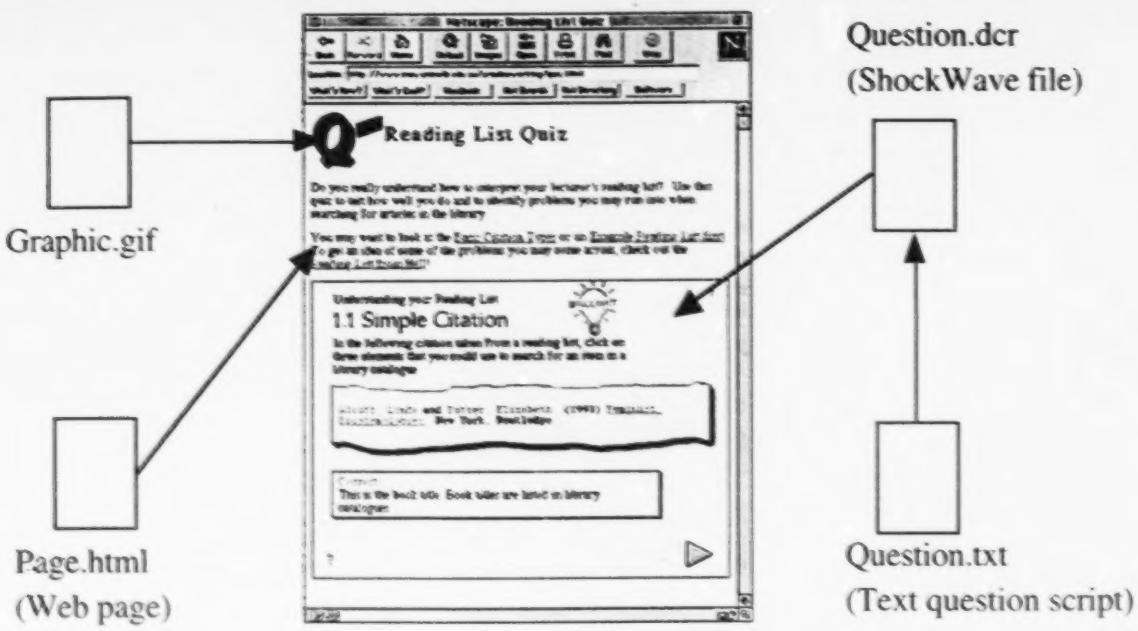

Figure 3. Structure of an Ariadne Collection page

SECTION_ 1. Understanding your Reading List

QUESTION_ Book Citation
STEM_ "In the following citation taken from a reading list, click on three elements that you could use to search for an item in a library catalogue."
ACTIVEFIELD_ "Alcoff, Linda and Potter, Elizabeth. (1993) Feminist Epistemologies, New York, Routledge."
CRITERION_ "Alcoff, Linda", true, "Correct!
Alcoff is one of the book authors. Book authors are listed in library catalogues."
CRITERION_ "Potter, Elizabeth", true, "Correct!
Elizabeth is one of the book authors. Book authors are listed in library catalogues."
....

Table 1. Section of interactive question script generated by content experts.

Impact on development and implementation

While the intention was to simply translate an existing tutorial, both the move to Web delivery and the newly created ability for content experts to easily create and modify topic pages and interactive questions resulted in significant shifts in the nature of the project.

Program Design

The design of on-line pages involved active consideration and adaptation of materials beyond those of the actual project. For example, hyperlinks both to and from external Web pages have been created and abbreviations/glossary information from the original program merged with external resources to better service the whole site (figure 2).

A major development component of Ariadne's Thread centred on navigational interface design, involving choice of metaphors, programming, user evaluation etc. This 'packaging', a common feature of many CFL programs, arguably has little direct impact on the educational purpose of the program. In contrast, the Web browser interface provides a standardised navigational framework. Multiple, re-sizeable and extended page views, with efficient scrolling, handles information more efficiently and without the painstaking design and chunking associated with the fixed 640 x 480

screen format. While the graphics in the original program was not extensive, some additional thought was required to optimise the Web file sizes.

Production

The iterative prototyping approach of Ariadne's Thread was typical of many traditional CFL projects. It could be described as *development-centred*, involving a drawn out, collaborative effort in content design, interface design and programming to produce each prototype (figure 3).

- The development task tended to dominate time and budgets
- Prototype evaluation did not always reflect the experience of implementation
- The production cycle was slow to respond to observed changes in need

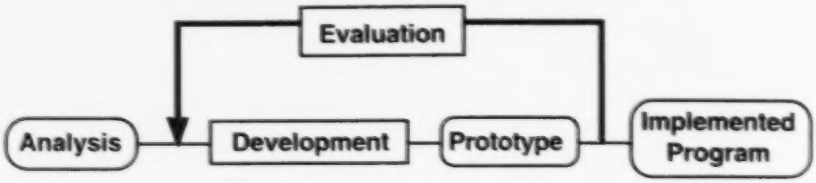

Figure 4. Production cycle Ariadne's Thread.

Production of the Collection on the other hand, appeared to reflect the more modular nature of the materials with the activities separating into two distinct levels, 'expert' and 'situated' (figure 5).

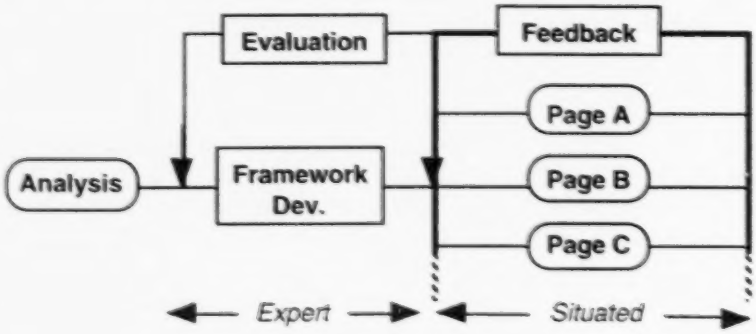

Figure 5. Production cycle of the Collection.

Expert activities involved specialist professional and technical expertise in the design and programming of interactive element mechanisms, formats, network logging systems, templates for pages etc. Output of this activity provided a framework to facilitate the second level of development activities, situated far more within the context of implementation.

Situated activities involved content experts in the on-going process of writing, implementing, reflecting and refining materials. This could be considered an aspect of normal teaching practice.

Implementation

In sixty time-tabled computer laboratory sessions spread over 9 weeks in 1995, only 290, or 15% of the target group made use of Ariadne's Thread. Students attended more sessions early in the semester, the anecdotal evidence being that, at the time of actual need, pressure of studies made sessional attendance difficult. On the other hand, the Collection potentially can be accessed at any time by students from all courses and levels, staff members and even the public. Access could be from home or any of the computer laboratories around the University. There is a distinct change in the nature of the materials here - rather than providing a goal-based *training* solution the observed problem, the Collection has the capability of providing on-demand *performance support* for students. This support has the potential of linking directly from the Catalogue access page.

Moreover, content experts are now able to respond immediately to needs observed within the library or from feedback to the lecturers. It is anticipated that the Collection will continue to evolve in this manner, complementing other Web resources being developed concurrently. With the limitations imposed by the requirements for specialised software and lab-based delivery are removed, it is expected that this responsibility may well extend to increasing numbers of content experts. While computer class sessions may still be organised for the following year, these are likely to include network skills and resources. It is intended that other forms of on-line support will be incorporated, for example email link to enable students to post queries directly to an electronic help desk with responses summarised on a Web page.

In this more 'democratic' environment, questions of ownership and responsibility have arisen which will need to be addressed, for example:

Should the Arts Faculty continue to fund such developments if significant use of the materials is made by 'outsiders'?

How will on-going refinement of materials or hotline support be accommodated into existing budgets and infrastructures?

While the prospect of a publishing a saleable product existed for the original project, what commercial potential does the Collection have?

Will pages of the Collection be identified as such to the user?

Evaluation

The move from scheduled laboratory to open access, on-line delivery means that students' usage patterns have become harder to determine. To assist in this, a Web-based system of gathering detailed audit trails of students' actions has been put in place, and visual mapping analysis of the audit trails will be undertaken in a manner similar to that employed for the original program (Fritze, 1994). Figure 5 indicates that the process of review takes place at two levels. Formal *expert evaluation* will be extremely important in understanding, not only how and when students use these on-line materials, but also how the implementation process itself is progressing. *Situated feedback* will be the key to successful on-going development of the materials, and in the end, most likely to provide evidence justifying continued involvement. It is important that an efficient process of reporting usage patterns and other feedback be made available to content experts as an integral component of implementation. Feedback will be available from such sources as email and help desk queries, detailed records maintained by the catalogue system itself, as well as by questionnaire and focused student interviews.

Concluding remarks

At the time of writing, with the first pages of the Ariadne Collection at implementation stage, a significant change in the nature of a traditional computer-based teaching project is evident - its development and implementation processes and impact on the student learning and departmental infrastructure. This change has been seeded in part by the increased modularity and open delivery of on-line Web materials, and in part by the development of specialised interactive learning devices and support tools. In particular, the shift from 'authoring' to 'writing' tools has shifted the locus of project control from the technical to educational, involving teaching staff more directly in development and implementation. A simultaneous shift from a development-centred project approach to one that is implementation focused, has increased the potential of responding to learning needs on an on-going basis. To capitalise on these opportunities however, changes in the understandings of teaching, development and administrative staff will need to further develop, supported by professional development activity and the continuing evaluation of the current implementation.

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